HortScience 44(3):828–832. 2009.

'NASPOT 7', 'NASPOT 8', 'NASPOT 9 O', 'NASPOT 10 O', and 'Dimbuka-Bukulula' Sweetpotato

Robert O.M. Mwanga[1], Benson Odongo, Charles Niringiye, Agnes Alajo, Benjamin Kigozi, Rose Makumbi, Esther Lugwana, Joweria Namukula, and Isaac Mpembe
National Agricultural Research Organization (NARO), National Crops Resources Research Institute (NaCRRI), Namulonge, P.O. Box 7084, Kampala, Uganda

Regina Kapinga, Berga Lemaga, James Nsumba, and Silver Tumwegamire
International Potato Center (CIP), Box 22274, Kampala, Uganda

Craig G. Yencho
Department of Horticultural Science, North Carolina State University, Room 214A Kilgore Hall, Box 7609, Raleigh, NC 27695-7609

Additional index words. Ipomoea batatas, Sweetpotato virus disease, Alternaria bataticola blight, provitamin A

Five sweetpotato [*Ipomoea batatas* L. (Lam.)] cultivars named NASPOT 7 (Namulonge Sweetpotato 7), NASPOT 8, NASPOT 9 O (Namulonge Sweetpotato 9 orange-fleshed), NASPOT 10 O, and Dimbuka-Bukulula were approved for release by the Ugandan Plant Variety Release Committee in July 2007 (Mwanga et al., 2007a). This is the fourth group of sweetpotato cultivars to be officially released by the Sweetpotato Program in Uganda. The first three groups were released in different years, six in 1995 (Mwanga et al., 2001), six in 1999 (Mwanga et al., 2003), and two in 2004 (Mwanga et al., 2007c). The five cultivars released in 2007, described here, have acceptable storage root shapes when grown in light soils. They also have high dry matter content (≈30%) and good to excellent consumer acceptance, particularly among children younger than 6 years old and women (Mwanga et al., 2007b, Odongo et al., 2002; Potts and Nagujja, 2007; Wamaniala, 2008). The cultivars have low to moderate levels of field resistance to sweetpotato virus disease (SPVD) and *Alternaria bataticola* blight and high storage root yields compared with the average national storage root yield of 4.0 t·ha^{-1} (International Potato Center, 1999). The release of these five cultivars provides consumers and farmers with high-quality sweetpotatoes with cream- and orange-fleshed storage roots and moderate to high provitamin A contents with potential to alleviate widespread vitamin A deficiency in Uganda and other developing countries (Jaarsveld et al., 2005; Low et al., 2007; Ruel, 2001; UDHS, 2001) and contribute to food security (Mwanga et al., 2007a).

Received for publication 11 Feb. 2009. Accepted for publication 23 Mar. 2009.
This work was supported, in part, by a grant from The McKnight Foundation, Collaborative Crop Research Program.
[1]To whom reprint requests should be addressed; e-mail rmwanga@naro-ug.org.

Origin

Throughout evaluation at the National Crops Resources Research Institute (NaCRRI), Namulonge, and in on-station and on-farm trials in major selected agroecologies in Uganda, the five clones were coded using the following nomenclature: Namulonge *Ipomoea* selection (NIS)/the initial year selected/the female parent/the selection (genotype) number/similarity code number (if present). The codes for the releases were 'NASPOT 7' (NIS/2002/SPK004/1), 'NASPOT 8' (NIS/2002/SPK004/1/1), 'NASPOT 9 O' (NIS/2002/SPK004/6), 'NASPOT 10 O' (NIS/2002/SPK004/6/6), and 'Dimbuka-Bukulula' (Dimbuka). 'Dimbuka-Bukulula', collected from Bukulula subcounty in Masaka District, is a superior Ugandan farmers' cultivar selected out of 1256 landrace germplasm accessions. The sweetpotato germplasm was collected from 21 major sweetpotato-producing districts in Uganda and assembled at NaCRRI in 2006. The pedigree of 'Dimbuka-Bukulula' is not known, but it is assumed to be a chance seedling or sport selected by farmers. The other four cultivars, NASPOT 7, NASPOT 8, NASPOT 9 O, and NASPOT 10 O, are seedling selections from the sweetpotato program at NaCRRI and were selected from bulked seed from an open-pollinated polycross nursery of 24 parents grown during 2000 to 2001. The 24 parents in the polycross block consisted of 10 released cultivars, three introductions, five advanced clones from the Ugandan sweetpotato breeding program, and six landrace cultivars (Table 1). The three introductions, Zapallo (PI 420027), Jewel (PI 440031), and Beauregard (PI 440132), were received from the International Potato Center (CIP), Lima, Peru, as pathogen-tested in vitro plantlets. The six landraces and the districts (in parentheses) from where they were collected were 'Arivumaku-2' and 'Ngujja' (Arua), 'Kala' (Kumi), 'Kanyasi' (Kabale), 'Araka' (Soroti), and 'Bunduguza' (Kamuli). The 24 parents were included in the polycross nursery for improvement or as sources of one or a combination of genes for control of desirable traits such as orange-fleshed roots (provitamin A), high dry matter (30% or greater), resistance to SPVD and Alternaria stem blight, and early maturity (3 to 4 months) (Table 1). The four released breeding lines described here were all progenies of 'Kakamega' ('SPK004') as the female parent, but because seed was open-pollinated, their male pedigrees are not known.

Diffusion of Cultivars

The global HarvestPlus Program (HarvestPlus, 2007; Pfeiffer and McClafferty, 2007) was involved in an effectiveness case study to promote orange-fleshed sweetpotato (OFSP) to alleviate vitamin A deficiency in Uganda. The OFSP high provitamin A cultivars, NASPOT 9 O and NASPOT 10 O (Bengtsson et al., 2008), were given new names, 'Vita' and 'Kabode', respectively, in the HarvestPlus project areas (Wamaniala, 2008).The adoption rates for both 'NASPOT 9 O' and 'NASPOT 10 O' in three target HarvestPlus project area districts in Uganda reached 100% (3261) in Bukedea, 90% (3504) in Kamuli and 80% (3511) in Mukono; the numbers in parentheses were households growing both cultivars by Sept. 2008, three seasons after the farmers received them (Wamaniala, 2008). Spread of the other released cultivars in the three and other districts was not as fast and was mainly through farmer-to-farmer exchange or sale of planting materials and promotions by nongovernment organizations, schools, farmer groups, and government departments. In the absence of a seed company that deals in sweetpotato-planting materials, the released cultivars have already reached the following 22 districts in Uganda: Amuria, Bukedea, Busia, Jinja, Kabale, Kampala, Kamuli, Karamoja, Katakwi, Kayunga, Kumi, Lira, Manafwa, Masaka, Mayuge, Mpigi, Mukono, Nakasongola, Padel, Soroti, Tororo, and Wakiso (Potts and Nagujja, 2007; Wamaniala, 2008).

Description and Performance

The five released cultivars were evaluated for five seasons on-station at Namulonge in seedling, observation, preliminary and intermediate trials between 2002 and 2004, and for three seasons in on-station and on-farm trials between 2004 and 2006 in replicated,

Table 1. Origin and main attributes of 24 sweetpotato parents used in the 2001/2002 polycross nursery at Namulonge, Uganda.

Code	Female parent	Origin of parent	Year released/status/ germplasm (GM)	Desirable/undesirable trait
1	SPK004 (Kakamega)	Kenya	2004	OF[z], HDM[y], moderately resistant to SPVD[x]
2	Ejumula	Uganda (landrace)	2004	OF, HDM, highly susceptible to SPVD
3	NASPOT 1	Uganda (bred clone)	1999	OF, HDM, high root yield, susceptible to AB[w]
4	NASPOT 3	Uganda (bred clone)	1999	HDM, moderately resistant to SPVD
5	NASPOT 4	Uganda (bred clone)	1999	Resistant to SPVD
6	NASPOT 5	Uganda (bred clone)	1999	OF, HDM, resistant to SPVD, susceptible to AB
7	New Kawogo	Uganda (landrace)	1995	HDM, resistant to SPVD, susceptible to AB, aggressive to weeds
8	Bwanjule	Uganda (landrace)	1995	HDM, resistant to SPVD
9	Sowola	Uganda (landrace)	1995	HDM, early maturity, light canopy
10	Tanzania	Uganda (landrace)	1995	HDM, taste, moderately resistant to SPVD
11	Zapallo (420027)	CIP/Peru	GM	OF, moderate resistance to AB, susceptible to SPVD
12	Beauregard (44013)	CIP/Peru	GM	OF, good root shape, susceptible to SPVD
13	Jewel (440132)	CIP/Peru	GM	OF, susceptible to SPVD
14	NIS/199/23/60	Uganda (bred clone)	Breeding line	OF, susceptible to SPVD
15	NIS/93/29	Uganda (bred clone)	Breeding line	HDM, resistant to SPVD
16	NIS/199/18/1	Uganda (bred clone)	Breeding line	OF, susceptible to SPVD
17	NIS/199/4/4	Uganda (bred clone)	Breeding line	OF, HDM, susceptible to SPVD
18	NIS/1990/Sowola-6	Uganda (bred clone)	Breeding line	OF, susceptible to SPVD
19	Ngujja	Uganda (landrace)	GM	OF, susceptible to SPVD
20	Arivumaku-2	Uganda (landrace)	GM	OF, low root yield
21	Bunduguza	Uganda (landrace)	GM	HDM, resistance to sweetpotato weevil
22	Araka	Uganda (landrace)	GM	Adapted to short grassland area
23	Kala	Uganda (landrace)	GM	OF, HDM,
24	Kanyasi	Uganda (landrace)	GM	HDM, susceptible to AB

[z]OF = orange flesh of storage roots.
[y]HDM = high dry matter (30% or more in storage roots).
[x]SPVD = sweetpotato virus disease.
[w]AB = *Alternaria bataticola* blight.

Table 2. Morphological descriptors of five sweetpotato culivars released in Uganda in July 2007.[z]

Descriptor	Cultivar				
	NASPOT 7	NASPOT 8	NASPOT 9 O	NASPOT 10 O	Dimbuka-Bukulula
Plant type	Semierect	Semierect	Semierect	Semierect	Semierect
			Vine pigmentation		
Predominant color	Green	Green	Green	Green	Green
Secondary color	Purple tip	Purple tip	Purple tip	Purple tip	Green tip
			Mature leaf shape		
Genaral outline	Lobed	Lobed	Lobed	Lobed	Triangular
Lobe type	Deep	Deep	Deep	Moderate	No lateral lobes
Lobe number	5	5	7	7	1
Shape of central lobe	Elliptic	Elliptic	Elliptic	Semielliptic	Triangular
			Foliage color		
Mature leaf	Green	Green	Green	Green	Green
Abaxial leaf vein	Purple	Purple	Purple	Green	Green
Immature leaf	Green with purple edge	Green with purple edge	Light purple	Light purple	Green
Petiole pigmentation	Green with purple near blade	Green with purple near blade	Green	Green with purple near blade	Green
			Flowering		
Habit	Sparse	Moderate	Sparse	Sparse	Moderate
Stigma exertion	Same as highest anther	Inserted (shorter than highest anther)	Slightly exerted	Same as highest anther	Inserted (shorter than highest anther)
			Capsule		
Seed set	Scarce	Sparse	Scarce	Sparse	Moderate
			Storage root		
Formation	Open cluster	Dispersed	Open cluster	Open cluster	Open cluster
Shape	Obovate	Long irregular or curved	Obovate	Long irregular or curved	Long irregular or curved
Surface defects	Horizontal constrictions	Horizontal constrictions	Longitudinal grooves	Horizontal constrictions	Longitudinal grooves
			Skin color		
Predominant	Purple-red	Purple–red	Purple–red	Purple–red	Cream
Intensity	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate
Secondary	Absent	Absent	Absent	Absent	Absent
			Flesh color		
Predominant	Intermediate orange	Pale orange	Intermediate orange	Dark orange	Cream
Secondary	Absent	Yellow	Absent	Absent	Absent

[z]Selected descriptors according to International Potato Center, AVRDC, and IBPGR (1991).

Table 3. Yield, quality attributes, and disease and insect pest reaction of five sweetpotato cultivars released in Uganda in July 2007.

Attribute	NASPOT 7	NASPOT 8	NASPOT 9 O	NASPOT 10 O	Dimbuka-Bukulula	Tanzania (local control)
Dry matter (DM) percent (range)	31.7 (28.4–34.9)	32.0 (30.5–36.1)	30.1 (27.5–31.1)	30.5 (27.8–32.5)	32.4 (26.9–35.9)	32.0 (27.5–35.5)
Cooked texture	Somewhat dry	Somewhat dry	Somewhat dry	Somewhat dry	Somewhat dry	Somewhat dry
Sweetness	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Field reaction to weevils[z]	S	S	S	S	S	S
Field reaction to SPVD[z y]	MR	MR	MR	MR	S	MR
Field reaction to Alternaria stem blight[z]	MR	MR	MR	MR	MR	MR
Maturity (days)	115	120	125	110	128	120
Mean and (range[x]) of storage root yields in various yield trials ($t \cdot ha^{-1}$)	20.4 (7.4–37.9)	17.8 (8.0–33.1)	16.5 (8.1–27.6)	16.0 (5.3–35.4)	25.0 (11.2–49.9)	17.6 (3.9–32.9)
Mean storage root yield (% of local control)	116	101	94	91	142	100
Beta-carotene content ($\mu \cdot g^{-1}$ DM)[w]	108.1 (44.3–192.7)	143.6 (85.6–219.3)	314.5 (206.3–460.3)	246.2 (185.6–324.8)	17.3 (13.3–24.1)	21.5 (13.8–36.3)

[z]Susceptible (S) = considerable damage or numbers present to severe damage or very high numbers present, respectively; Moderately resistant (MR) = moderate damage or moderate numbers present (resistant = little or no apparent damage or few or no insects present).
[y]SPVD = sweetpotato virus disease.
[x]The wide variation in yield is attributed to variation in environmental factors such as erratic rain during some seasons and differences in farm management and soil types in the different agroecologies.
[w]The wide variation in provitamin A (beta-carotene) content is attributed to various factors such as agroclimatic conditions [e.g., different soil types, time of sampling (wet/ dry season)], different methods used in its determination, age and size of the sampled roots, methods of harvesting and postharvest handling of root samples, processing, and storage.

Table 4. Yield of 'NASPOT 7' to 'NASPOT 10 O', 'Dimbuka-Bukulula', and 'Tanzania' in four sites in Uganda.

	Site[z]								
Cultivar	Namu longe	Kachwe kano	Ngetta	Serere	Mean across sites	Biomass across sites ($t \cdot ha^{-1}$)	DMC[x] across sites %	SPVD[w] at Namu longe	Alternria at Kachwe kano
	Storage root yield[y] ($t \cdot ha^{-1}$)								
					2004				
NASPOT 7	59.7	59.0	11.5	10.5	35.2	87.8	30.1	2.0	2.0
NASPOT 8	42.2	39.3	9.3	7.0	24.7	77.3	30.7	1.7	2.0
NASPOT 9 O	50.4	33.7	12.8	6.0	25.7	62.5	29.4	1.8	2.3
NASPOT 10 O	38.3	28.0	9.8	7.9	21.0	43.2	32.6	2.3	2.0
Dimbuka-Bukulula	58.4	52.1	19.5	15.9	36.5	64.0	32.3	3.0	3.0
Tanzania (control)	32.9	58.4	16.5	5.3	28.3	77.3	34.6	2.2	2.0
Mean	47.0	45.1	13.2	8.8	28.6	68.7	31.6	2.2	2.2
$LSD_{0.05}$	13.1	15.8	5.0	3.8	5.4	9.3	NA	0.4	0.9
					2005				
NASPOT 7	28.7	19.7	7.4	13.2	17.3	42.8	31.5	1.4	2.0
NASPOT 8	23.5	20.7	8.1	4.6	14.2	40.4	31.4	1.3	2.0
NASPOT 9 O	17.1	11.2	15.6	9.5	13.4	28.4	30.3	2.3	2.3
NASPOT 10 O	16.4	15.4	12.1	19.7	31.8	34.3	30.6	2.1	2.3
Dimbuka-Bukulula	16.5	29.0	15.6	14.5	18.9	32.8	32.9	2.1	3.0
Tanzania (control)	24.3	20.9	14.8	11.7	17.9	28.8	30.9	1.6	2.0
Mean	21.1	19.5	12.3	12.2	18.9	34.6	31.3	1.8	2.3
$LSD_{0.05}$	5.3	6.3	2.8	5.0	2.3	5.8	NA	0.9	0.9
					2006				
NASPOT 7	41.7	52.5	8.7	17.5	30.1	57.9	30.5	2.3	1.5
NASPOT 8	28.6	35.7	7.0	32.3	25.9	50.0	30.1	2.3	1.3
NASPOT 9 O	25.4	32.0	6.8	21.7	21.5	43.7	30.3	2.8	1.8
NASPOT 10 O	26.6	28.6	5.8	31.8	23.2	48.6	33.9	2.3	1.5
Dimbuka-Bukulula	53.0	51.4	11.2	50.2	41.5	63.9	32.3	3.0	2.0
Tanzania (control)	22.9	20.7	10.1	16.1	17.5	52.8	31.5	3.0	1.9
Mean	33.0	36.8	8.3	28.3	26.6	52.8	31.4	2.6	1.7
$LSD_{0.05}$	14.5	14.2	3.5	8.4	6.2	13.2	NA	0.6	0.8

[z]Sites: Namulonge is the warm, moist, tall grasslands (high SPVD pressure agroecology); Ngetta and Serere are in the warm, subhumid short grasslands (has high weevil populations during dry periods); and Kachwekano is the cool, moist, southwestern highlands (has high Alternaria blight pressure).
[y]Mean of four replications. Planting was in a randomized complete block design (RCBD); 80 plants on five ridges (1 m × 30 cm) per plot; only the 48 middle plants were harvested for yield determination.
[x]DMC = dry matter content; NA = not applicable, statistical analysis not done.
[w]SPVD, sweetpotato virus disease and Alternaria blight severity rating scale, 1 = no symptoms; 2 = mild symptoms; 3 = mild symptoms; 4 = severe symptoms; and 5 = very severe symptoms.
LSD = least significant difference.

standardized, multilocation yield trials in three major agroecologies: 1) the warm, subhumid short grasslands where sweetpotato weevils and drought are important; 2) the warm, moist, tall grasslands where SPVD is severe; and 3) the cool, moist, southwestern highlands where Alternaria stem blight and low soil fertility stresses are prevalent. Mwanga et al. (2007a) provided detailed descriptions of pedigree, test sites, cultivars, planting materials, on-station and on-farm trials, planting and harvesting dates, farmer selection criteria, experimental designs, stability analysis, production package, and cultivar maintenance.

Table 5. Performance of 'NASPOT 7' to 'NASPOT 10 O', 'Dimbuka-Bukulula', and local checks in on-farm trials in Uganda.

District[z]/year	Cultivar	Yield[y] (t·ha^{-1})		Disease severity[x]		Taste test rank[w]
		Root	Biomass	SPVD	Alternaria	(n = 15; M = 4, F = 11)
Mpigi 2005	NASPOT 7	11.2	30.7	2.2	3.0	6
	NASPOT 8	15.0	30.1	2.0	1.2	3
	NASPOT 9 O	13.7	26.1	2.0	1.5	2
	NASPOT 10 O	10.5	20.4	2.0	1.4	1
	Dimbuka-Bukulula	17.8	35.1	2.4	1.6	4
	Namubiru (control)	8.2	20.0	2.6	1.4	5
	Mean	12.7	27.1	2.2	1.7	NA
	$LSD_{0.05}$	4.5	8.8	NS	0.8	NA
						(n = 24; M = 5, F = 19)
Mpigi 2006	NASPOT 7	7.3	20.2	2.4	3.4	5
	NASPOT 8	12.7	29.4	2.6	2.2	3
	NASPOT 9 O	13.3	23.9	2.6	2.0	1
	NASPOT 10 O	9.7	20.8	2.6	2.0	2
	Dimbuka-Bukulula	12.4	27.5	3.0	2.2	4
	Semanda (control)	12.1	31.3	3.0	2.6	6
	Mean	11.3	25.5	2.7	2.4	NA
	$LSD_{0.05}$	4.1	8.0	0.5	0.9	NA
						(n = 20; M = 3, F = 17)
Busia 2006	NASPOT 7	14.0	28.5	2.0	1.0	3
	NASPOT 8	16.5	32.6	2.0	1.0	5
	NASPOT 9 O	14.9	22.9	1.8	1.4	2
	NASPOT 10 O	14.9	22.1	2.0	1.0	1
	Dimbuka-Bukulula	16.3	23.6	2.4	1.0	6
	Musiita (control)	16.8	27.8	1.8	1.0	4
	Mean	15.6	26.3	2.0	1.1	NA
	$LSD_{0.05}$	NS	8.3	NS	0.2	NA
						(n = 23; M = 5, F = 18)
Kabale 2006	NASPOT 7	16.1	31.5	2.2	1.3	4
	NASPOT 8	23.0	78.4	1.7	1.0	5
	NASPOT 9 O	15.4	31.5	2.0	1.2	1
	NASPOT 10 O	17.2	34.4	2.0	1.2	6
	Dimbuka-Bukulula	21.0	43.7	2.0	1.2	2
	Nderera (control)	24.0	49.7	2.2	1.2	3
	Mean	19.5	44.9	2.0	1.2	NA
	$LSD_{0.05}$	NS	3.6	NS	NS	NA
						(n = 18; M = 4, F = 14)
Nakasongola 2006	NASPOT 7	15.5	32.8	2.0	1.1	5
	NASPOT 8	14.4	30.4	1.8	1.2	3
	NASPOT 9 O	13.3	24.3	1.8	1.0	1
	NASPOT 10 O	14.4	30.0	1.8	1.3	2
	Dimbuka-Bukulula	18.7	34.0	2.0	1.1	4
	Nayiloni (control)	9.8	25.6	2.0	1.0	6
	Mean	14.4	29.5	1.9	1.1	NA
	$LSD_{0.05}$	5.1	5.6	NS	NS	NA
						(n = 21; M = 5, F = 16)
Wakiso 2006	NASPOT 7	9.2	30.9	2.2	1.2	6
	NASPOT 8	11.4	33.7	1.4	1.1	3
	NASPOT 9 O	9.5	29.6	1.8	1.3	5
	NASPOT 10 O	5.8	17.9	2.0	1.4	2
	Dimbuka-Bukulula	11.1	36.1	2.2	1.2	4
	Nansana (control)	9.9	36.2	2.6	1.2	1
	Mean	9.5	30.7	2.0	1.2	NA
	$LSD_{0.05}$	2.9	3.2	0.5	NS	NA

[z]Mpigi and Wakiso districts represent the warm, moist tall grasslands; Nakasongola and Busia, the warm subhumid short grasslands; and Kabale, the cool moist southwest highlands.
[y]Yields were based on 10 to 15 farms per district, gross plot was 30 m^2 (30 mounds), middle or net plot harvested was 12 m^2 (12 mounds of 36 plants); each farm in a district was treated as a replicate. NS = nonsignificant.
[x]SPVD = sweetpotato virus disease and Alternaria blight severity in field evaluation, rating scale, 1 = no symptoms; 2 = mild symptoms; 3 = mild symptoms; 4 = severe symptoms; and 5 = very severe symptoms.
[w]Taste test rank was based on the aggregate pairwise comparison of the panel (farmers); n = number of farmers in the tasting panel, M = male, F = female; 1 = most preferred; 6 = least preferred; NA = not applicable.
LSD = least significant difference.

A total of eight multilocational on-station and 13 on-farm trials were conducted under rain-fed conditions, but only data for years 2004/2005–2006 are presented where the original number of clones (68,874) selected from the seedling nursery had been reduced to less than 10 for on-farm trials (Mwanga et al., 2007a). In the trials, the cultivars (Table 2) were evaluated to confirm resistance to SPVD, Alternaria stem blight (Tables 3 and 4), and sweetpotato weevils, *Cylas puncticollis* (Boheman) and *C. brunneus* (Fabricius) (Table 5). Classifications of the relative resistance to disease and weevil damage were based on field evaluation under natural disease and weevil population pressures as described by Mwanga et al. (2007b, 2002). The level of infection varied from low to high depending on agroecology, represented by Namulonge for high SPVD pressure, Kachwekano for high Alternaria blight pressure, and Serere and Ngetta for high weevil populations during dry periods. Storage root dry matter content, root yield, taste, and desirable agronomic attributes such as earliness (90 to 120 d to maturity), root size, shape (Tables 1 and 2), and storage root yield were also evaluated (Tables 3–5). The mean root yields of the released cultivars across sites varied in on-station (Table 4) and on-farm trials (Table 5), but they were above the national average of 4.0 t·ha^{-1}. In over 70% of the cases, the yields of the cultivars were as good as or better than the local control cultivars (Tables 3–5) in the different agroecologies. 'NASPOT 9 O' and 'NASPOT 10 O' varied in root yield and biomass, but they have orange fleshed-storage roots with more provitamin A than Dimbuka-Bukulula and Tanzania, which have cream-fleshed roots that have very little provitamin A (beta-carotene) determined by spectrophotometry and high-performance liquid chromatography (Fig. 1; Table 3). Compared with the local checks, Dimbuka-Bukulula had higher root yields on station at most sites and gave equal or better yields on farm. Yield trends reported here are similar to the sweetpotato yield trends reported by Abidin et al. (2005), Grüneberg et al. (2005), and Manrique and Hemann (2002) who pointed out the need to select under high yielding and marginal environments when breeding for wide and specific adaptations. Although relative ranking in taste evaluations varied on different farms, the released cultivars had high acceptability on most farms (Table 5).

The five released cultivars are susceptible to sweetpotato weevils in no-choice laboratory tests and under dry season field condition evaluations. To date, there are no sweetpotato cultivars with high resistance to sweetpotato weevils in the world sweetpotato germplasm collections. The five released cultivars have moderate field resistance to Alternaria stem blight. 'Dimbuka-Bukulula' is susceptible to SPVD at Namulonge where the natural SPVD inoculum pressure is high and devastating to susceptible clones, but the NASPOT cultivars have moderate field resistance to the disease. These released cultivars are expected to perform well in agroecologies with low to high SPVD pressure and with well-distributed rainfall for at least 3 months soon after planting and during the early growth cycle.

Availability

The cultivars are maintained as pathogen-tested plants in the screenhouse at the Quarantine Station, Muguga, Kenya, and are maintained in the field by NaCRRI in Uganda. Requests for these cultivars should be addressed to: Seed Unit, CIP, P.O. Box 25171, Nairobi, Kenya. Requests for planting materials within Uganda should be directed

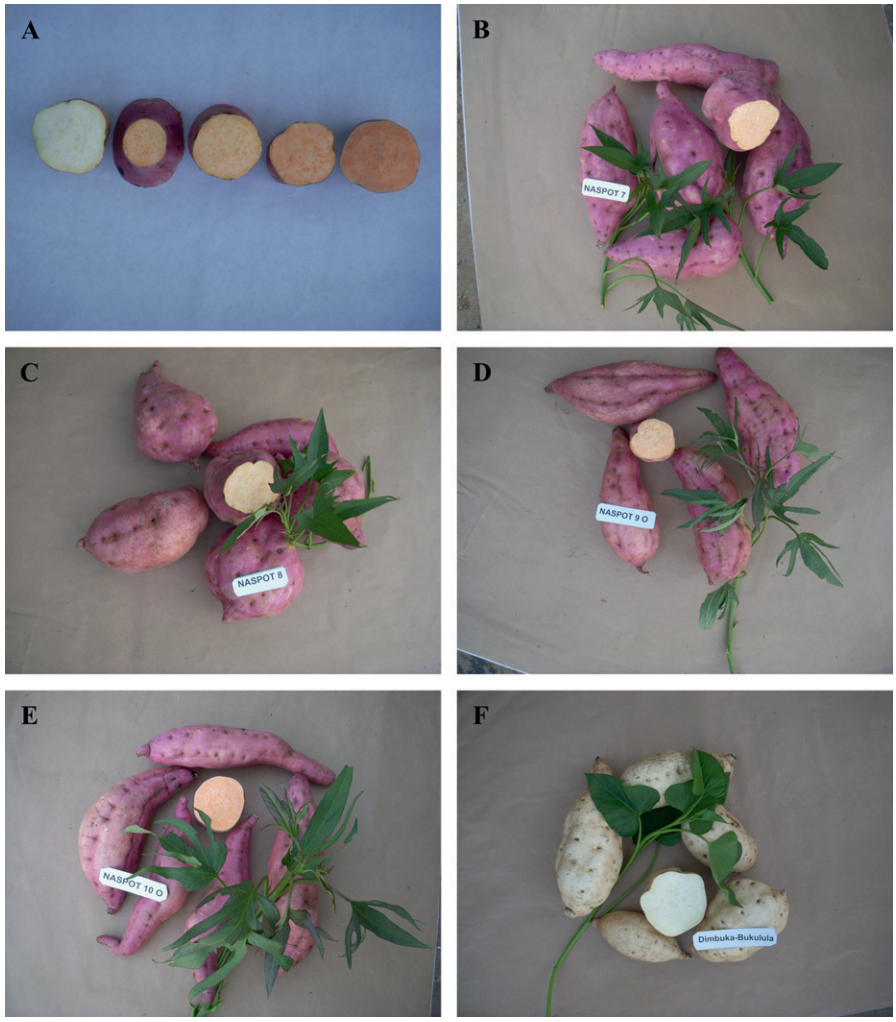

Fig. 1. Cross section of root and shoot of 'Dimbuka-Bukulula' (**A** and **F**) compared with 'NASPOT 7' (**B**), 'NASPOT 8' (**C**), 'NASPOT 9 O' (**D**), and 'NASPOT 10 O' (**E**).

to: Sweetpotato Program, NaCRRI, P.O. Box 7084, Kampala.

Literature Cited

Abidin, P.E., F.A. van Eeuwijk, P. Stam, P.C. Sturik, M. Malosetti, R.O.M. Mwanga, B. Odongo, M. Hermann, and E.E. Carey. 2005. Adaptability and stability of sweetpotato varieties for low-input systems in Uganda. Plant Breed. 124:491–497.

Bengtsson, A., A. Namutebi, M.L. Aminger, and U. Svanberg. 2008. Effects of various traditional processing methods on the all-*trans*-β-carotene content of orange-fleshed sweet potato. Journal of Food Composition and Analysis 21:134–143.

Grüneberg, W.J., K. Manrique, Z. Dapeng, and M. Hermann. 2005. Genotype × environment interactions for a diverse set of sweetpotato clones evaluated across varying ecogeographic conditions in Peru. Crop Sci. 45:2160–2171.

HarvestPlus. 2007. Breeding crops for better nutrition. 2 Jan. 2008. <http://www.harvestplus.org/pubshp.html#sp>.

International Potato Center (CIP). 1999. CIP sweetpotato facts: Production, consumption, feed use. CIP, Lima, Peru. Jan. 2009. <http://www.cipotato.org/sweetpotato/facts/>.

International Potato Center, Asian Vegetable Research and Development Center, and the International Board for Plant Genetic Resources. 1991. Descriptors for sweetpotato. In: Huaman, Z. (ed.). Intl. Board for Plant Genetic Resources, Rome, Italy.

Jaarsveld, P.J.v., M. Faber, S.A. Tanumihardjo, P. Nestel, and C.J. Lombard. 2005. β-Carotene-rich orange-fleshed sweet potato improves the vitamin A status of primary school children assessed with the modified-relative-dose–response. Amer. J. Clin. Nutr. 81:1080–1087.

Low, J., M. Arimond, N. Osman, B. Cunguara, F. Zano, and D. Tschirley. 2007. A food-based approach introducing orange-fleshed sweet potatoes increased vitamin A intake and serum retinol concentrations in young children in rural Mozambique. J. Nutr. 137:1320–1327.

Manrique, K. and M. Hemann. 2002. Comparative study to determine stable performance in sweetpotato [*Ipomoea batatas* (L.) Lam.] regional trials. Acta Hort. 583:87–94.

Mwanga, R.O.M., B. Odongo, A. Alajo, B. Kigozi, C. Niringiye, R. Kapinga, S. Tumwegamire, R. Makumbi, E. Lugwana, J. Namakula, B. Lemaga, J. Nsumba, and C. Yencho. 2007a. Submission to the Variety Release Committee for the release of sweetpotato varieties. National Agricultural Research Organization (NARO)/National Crops Resources Research Institute (NaCRRI), Kampala, Uganda.

Mwanga, R.O.M., B. Odongo, C. Niringiye, A. Alajo, P.E. Abidin, R. Kapinga, S. Tumwegamire, B. Lemaga, J. Nsumba, and E.E. Carey. 2007c. Release of two orange-fleshed sweetpotato cultivars, 'SPK004' ('Kakamega') and 'Ejumula' in Uganda. HortScience 42:1728–1730.

Mwanga, R.O.M., B. Odongo, C. Niringiye, R. Kapinga, S. Tumwegamire, P.E. Abidin, E.E. Carey, B. Lemaga, J. Nsumba, and D. Zhang. 2007b. Sweetpotato selection releases: Lessons learnt from Uganda. African Crop Science Journal 15:11–23.

Mwanga, R.O.M., B. Odongo, C.O. p'Obwoya, R.W. Gibson, N.E.J.M. Smit, and E.E. Carey. 2001. Release of five sweetpotato cultivars in Uganda. HortScience 36:385–386.

Mwanga, R.O.M., B. Odongo, G. Turyamureeba, A. Alajo, G.C. Yencho, R.W. Gibson, N.E.J.M. Smit, and E.E. Carey. 2003. Release of six sweetpotato cultivars ('NASPOT 1 to NASPOT 6') in Uganda. HortScience 38:475–476.

Mwanga, R.O.M., G.C. Yencho, and J.W. Moyer. 2002. Diallel analysis of sweetpotatoes for resistance to sweetpotato virus disease. Euphytica 128:237–248.

Odongo, B., R.O.M. Mwanga, F. Opio, C. Niringiye, C. Owori, R. Kapinga, L. Sserunjogi, F. Gita, B. Kyadondo, B. Lugwana, C. Kigozi, J. Namakula, and J. Nanteza. 2002. Evaluating selected orange-fleshed sweetpotato varieties for environmental adaption, biotic stress and farmer acceptability in Luwero, Uganda, p. 200–207. In: Tenywa, J.S., M.P. Nampala, S. Kayamanywa, and M. Osiru (eds.). Integrated Pest Management Conference Proc., Collaborative Research Support Program (CRSP). African Crop Science Society, Kampala.

Pfeiffer, W.H. and B. McClafferty. 2007. HarvestPlus: Breeding crops for better nutrition. Crop Sci. 47(suppl. 3):S88–S105.

Potts, J.M. and S. Nagujja. 2007. A Review of agriculture and health policies in Uganda with implications for dissemination of biofortified crops. HarvestPlus working paper No.1. Jan. 2009. <http://www.harvestplus.org/pdfs/sweetpotato.pdf>.

Ruel, M.T. 2001. Can food-based strategies help reduce vitamin A and iron deficiencies, a review of recent evidence. International Food Policy Research Institute, Washington, DC.

UDHS. 2001. Uganda Demographic and Health Survey, Uganda Bureau of Statistics. Entebbe, Uganda.

Wamaniala, M. 2008. Orange fleshed sweetpotato; reaching end users project in Uganda. HarvestPlus Program Project No. 6010, 2008 Semi-Annual Report.